



Patent
Attorney's Docket No. 033539-018

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of)
Wing Cheung HO et al.) Group Art Unit: 1725
Application No.: 09/649,084) Examiner: L. Edmondson
Filed: August 28, 2000) Appeal No.
For: WIRE-BONDING APPARATUS)
WITH IMPROVED XY-TABLE)
ORIENTATION)

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BRIEF FOR APPELLANT

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This appeal is from the decision of the Primary Examiner dated November 29, 2002, (Paper No. 13), finally rejecting the pending claims, which are reproduced as an Appendix to this brief.

A check covering the [] \$160.00 (2402) [X] \$320.00 (1402) Government fee and two extra copies of this brief are being filed herewith.

The Director is hereby authorized to charge any appropriate fees under 37 C.F.R. §§1.16, 1.17, and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 02-4800. A copy of this page and the signature page are submitted in duplicate.

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I. Real Party in Interest

The subject application, and the invention to which it is directed, are assigned to ASM Assembly Automation, Ltd., a Hong Kong corporation.

II. Related Appeals and Interferences

There are no other appeals or interferences known to appellants, their legal representative, or the assignee which will directly affect, or be directly affected by, or have a bearing on the Board's decision in this appeal.

III. Status of Claims

The present application contains claims 1-12, all of which are currently pending. Claims 1-11 stand finally rejected.

Claim 12 was added in the Amendment filed September 18, 2002. This claim was not addressed in the final Office Action dated November 29, 2002, nor in the Advisory Action dated June 13, 2003, and hence was apparently overlooked by the Examiner. For purposes of completeness, in this Brief the claim will be treated as if it had been finally rejected.

IV. Status of Amendments

No Amendments were filed subsequent to the final rejection.

V. Summary of the Invention

The claimed invention is directed to a wire bonding apparatus, for connecting the pads of an electronic component, such as a semiconductor die, to a supporting structure, such as a lead frame or integrated circuit board. Prior art examples of this type of apparatus are illustrated in Figures 1-3. Referring to Figure 1, for instance, a workpiece 1 is mounted on a rotatable table 2. The table 2 is mounted on slides 3, 4 that are adapted to move along mutually orthogonal axes X and Y. A bonding head 5 includes a transducer 6

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that extends along an axis. In the example of Figure 1, the longitudinal axis of the transducer is parallel to the X axis of translation. The example of Figure 2 is similar, except that the transducer is oriented along the Y axis of translation.

In operation, the workpiece is rotated on the table 2, so that the axis of the transducer 6 is oriented along a line between the two bonds that are to be connected by a wire. After the first bond is formed, the workpiece is moved along this line, until it is in the correct position for the bonding head 5 to form the second bond. In the apparatus of Figure 1, therefore, the workpiece 1 is moved along the X axis, whereas in the apparatus of Figure 2 it is moved along the Y axis. (Page 2, line 2 to page 3, line 2)

In the examples of Figures 1 and 2, the bonding head 5 is located within the interior of the angle defined by the X and Y axes of translation. In the example of Figure 3, the bonding head is located outside of this interior angle, and the transducer axis is perpendicular to a line that bisects the X and Y axes. In this arrangement, the workpiece is moved along both the X and Y axes to position it for the formation of the second bond.

(Page 3, lines 3-9)

The present invention differs from these conventional structures by virtue of the fact that the transducer 6 is located on a line that bisects the X and Y axes of translation. In the embodiment of Figure 4, the longitudinal axis of the transducer forms an angle of 45° with respect to each of the X and Y axes. In operation, the workpiece 1 is rotated via a support table 2, to align the first and second bond locations along the axis of the transducer. After the first bond is formed, the workpiece is moved simultaneously along both X and Y axes, until the bonding head 5 is located above the position for the second bond. (Page 5, line 22 to page 6, line 8)

In an alternative embodiment illustrated in Figure 6, the workpiece 1 and rotatable table 10 can remain in a fixed position, and the bonding head can be translated along the X and Y axes. (Page 6, line 19 to page 7, line 7)

Two advantages are associated with orienting the transducer axis along a line bisecting the X and Y axes of translation in this manner. First, it permits the operator to

position himself so that he can view the bonding operation along the transducer axis, as depicted by the arrow in Figure 5. By positioning himself in this manner, the operator is in an optimum location to observe the bonding process, and carry out any necessary alignment or setup procedures. (Page 6, lines 13-18)

Furthermore, by arranging the transducer axis along a line which bisects the X and Y axes of translation, the bonding head 5 moves along both axes simultaneously, rather than just one of the two axes as in the prior art structures of Figures 1 and 2. As a result, the traveling distance along each of the two axes is reduced by a factor of 0.707, to thereby increase the overall speed of a wire bonding operation. (Page 6, lines 9-13)

VI. Issues

The final Office Action presents three issues for consideration on this appeal:

1. Are claims 1-4, 6-8 and 10 anticipated by the Yoshida et al patent (U.S. Patent No. 4,039,114)?
2. Are claims 1-11 anticipated by the Amorosi et al patent (U.S. Patent No. 4,619,395)?
3. Are claims 1-5 and 8-11 anticipated by the Cheng et al patent (U.S. Patent No. 5,897,048)?

VII. Grouping of Claims

For purposes of the present appeal, the claims which are grouped in each ground of rejection can be considered to stand or fall together.

VIII. Argument

All three grounds of rejection at issue on this appeal are based upon anticipation under 35 U.S.C. §102(b). As set forth in MPEP §2131 and the cases cited therein:

TO ANTICIPATE A CLAIM, THE REFERENCE
MUST TEACH EVERY ELEMENT OF THE CLAIM

As discussed hereinafter, the statements of rejection do not address the specific language of the claims, and therefore fail to show that the references teach every element of the rejected claims.

A. The Yoshida et al Patent Does Not Anticipate the Claimed Subject Matter

Claims 1-4, 6-8 and 10 stand finally rejected under 35 U.S.C. §102, as being anticipated by the Yoshida et al patent, on the following basis:

Yoshida teaches a wedge wire bonding apparatus comprising a bonding head, a longitudinal ultrasonic transducer (horn, 15 in figure 5) and rotatable workpiece supporting means (col 4 lines 5-33). The bond head supporting means may be fixed in the x-y direction (movement in z direction and rotation only) with x-y movement or rotary movement of the workpiece (col 5 lines 32-60 and col 10 lines 16-36). Note that the rotation is around the z-axis, at least one of the angular positions around the z axis (between 0 and 90 degrees) would be 45 degrees (col 4 lines 19-27). An operator may observe the process (col 4 lines 52-60). As all of the parts of controllably moveable, all are capable of remaining fixed relative to one another and convention dictates that transducer axis would remain fixed during the actual bonding process. See also Yoshida claims 1 and 8-12.

This statement does not illustrate correspondence between the elements of the claims and the disclosure of the reference. More particularly, the claimed invention is directed to the orientation of the bond head transducer, relative to the X and Y translation axes for positioning the transducer and a workpiece relative to one another. As recited in claim 1, the X and Y axes define orthogonal directions along which the workpiece and transducer are moved relative to one another. The claim further recites that the bonding head

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transducer is maintained in a stationary orientation along a line dividing these X and Y axes. Thus, as illustrated in the embodiments of Figures 4 and 6, the bonding head transducer 6 is oriented at an angle of 45° relative to the X and Y translation axes.

The rejection based upon the Yoshida et al. patent focuses upon the fact that the workpiece can be rotated relative to the transducer about a Z axis. See, for example, the second and third sentences of the statement of rejection quoted above. The fact that the workpiece is rotatable about a Z axis has absolutely no bearing on the claimed subject matter, namely the orientation of the transducer relative to the X and Y *axes of translation*.

To illustrate, claim 1 recites, among other elements, "means for causing relative movement of the workpiece and the transducer along an X axis." In the Yoshida patent, the X axis along which the workpiece moves relative to the transducer is identified in Figure 11, and is defined by movement of the *x* displacement table 67 along the shafts 68a and 68b (column 11, lines 25-30). Claim 1 also recites "means for causing relative movement of the workpiece and the transducer along a Y axis orthogonal to said X axis." In the Yoshida patent, the Y axis is identified in Figure 9(b), and is defined by movement of the *y* displacement table 69 along the shafts 79a and 79b (see also Figures 11 and 12, as well as column 11, lines 48-52). Referring back to Figure 5, the *x* and *y* displacement tables are located immediately below the positioning unit 10, which supports the workpiece-holding jig 7. As can be seen, the X axis is oriented parallel to the plane of the paper, and the Y axis is perpendicular to the plane of the paper.

Claim 1 goes on to recite "means for maintaining the bonding head in a stationary orientation above the workpiece such that the longitudinal axis of said transducer remains fixed along a line dividing said X and Y axes..." In Figure 5 of the Yoshida patent, it can be seen that the longitudinal axis of the transducer 14, 15 is oriented in the plane of the paper. Hence, this longitudinal axis is parallel to the X axis, rather than being along a line dividing the X and Y translational axes. The fact that the *workpiece* is rotatable about a Z (vertical) axis does not have any effect upon the orientation of the transducer relative to the

X and Y translational axes. In other words, rotation of the workpiece does not change the position of the *transducer* relative to the *X and Y axes of movement*.

The final Office Action states "the fixed transducer [of Yoshida] can remain at a 45-degree angle relative to the *x-y plane of the workpiece* when the workpiece is rotated" (Paper No. 13, page 4, numbered paragraph 4, emphasis added). However, the claim is not directed to the orientation of the transducer relative to the *workpiece*. Rather, the claim recites the relationship of the transducer relative to the *X and Y axes of movement*. The Yoshida patent does not disclose that the transducer is oriented along a line *dividing* the X and Y axes, as recited in subparagraph (e) of claim 1.

The rejection based upon the Yoshida patent does not address this element of the claims, and therefore does not identify how the Yoshida patent can be interpreted to anticipate the subject matter recited in the claims. At best, the Yoshida patent only discloses that the transducer is oriented *along* the X axis of movement, as in the prior art structure of Figure 1 of the present application. There has been no showing how the reference can be interpreted to anticipate the specific relationship of the transducer to the X and Y translational axes, as recited in the *claims*.

B. The Amarosi et al. Patent Does Not Anticipate the Claimed Subject Matter

Similar arguments apply with respect to the rejection based upon the Amorosi et al. patent. In particular, Figure 4 of that patent explicitly discloses that the longitudinal axis of the transducer 81 is oriented along the X axis of movement, rather a line dividing the X and Y axes. The fact that the workpiece 72 can be rotated about the Z axis does not have any effect upon the orientation of the transducer relative to the X and Y axes of movement.

C. The Cheng et al. Patent Does Not Anticipate the Claimed Subject Matter

The Cheng et al. patent discloses an arrangement in which the transducer is rotated about a vertical, or Z, axis. This rotation is described in the patent as movement in the θ direction (column 5, lines 14-15). In contrast, claim 1 recites "means for maintaining the

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bonding head in a *stationary* orientation above the workpiece..." (emphasis added). For this reason alone, therefore, the Cheng et al. patent does not anticipate claim 1, nor any of its dependent claims.

Furthermore, the claim recites that the transducer "remains *fixed* along a line dividing said X and Y axes at all times during relative positioning of the workpiece and the transducer, for each wire bonding operation" (emphasis added). The rejection based upon the Cheng et al. patent states that the transducer axis "is moved into position which remains fixed while the bond head moves vertically to effect the bond..." However, claim 1 does not merely recite that the transducer is fixed during the bonding operation, *per se*. Rather, it states that the transducer remains fixed "at all times *during relative positioning of the workpiece and the transducer*." By its very nature, the transducer of the Cheng et al. patent is not designed to remain in a fixed orientation during relative positioning of the workpiece and the transducer. Rather, the reason for making the transducer rotatable about a Z axis is to allow its orientation to be changed relative to the X and Y axes of movement during positioning. As stated in column 7, lines 54-57 of the patent, during the positioning of the bonder relative to the workpiece, "theta actuator 327 rotates the bonding head subassembly 518 so that the wire path is aligned with the wire feeding direction . . ." For this additional reason, therefore, the Cheng et al. patent does not anticipate the subject matter of claim 1, or its dependent claims.

In summary, the Cheng et al. patent does not disclose a bonding head that is maintained in a *stationary* orientation above the workpiece, and also remains fixed along a line dividing the X and Y axes "at all times during relative positioning of the workpiece and the transducer."

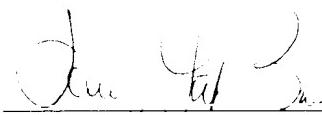
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IX. Conclusion

For the foregoing reasons, none of the three grounds of rejection is properly founded in the statute, and they should each be reversed.

Respectfully submitted,

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Date: August 29, 2003